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(54) Title: TRAINABLE USER INTERFACE TRANSLATOR

(57) Abstract

An apparatus and method for converting a first user interface used for existing applications running on a host computer to a second user interface for use on a client computer. The apparatus intercepts prompts and request for input from the host, converts them to a form appropriate for use on the client computer, and passes the converted prompts and requests to the client. The apparatus can store information for use at a later prompt or request, branch on the stored value to vary path execution, and handle errors generated by incorrect input.

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## Trainable User Interface Translator

### Background

This invention relates to integrating and translating software application user interfaces from a targeted computer system to a new computer system without modifying the underlying application.

Software developers, system integrators, value added resellers and end users are eager to utilize the leading edge handheld computers and portable data collection terminals. Yet, incorporating these new devices into existing software systems has proven difficult primarily because the computer system running the application must provide a user interface with a minimum functionality. For instance, an inventory system's user interface may require a screen capable of displaying 24 lines by 80 characters. Yet, a portable terminal may only provide 4 lines by 40 characters, and therefore be incapable of directly running the application. Since handheld or portable terminals typically do not provide the required minimum functionality, they are not capable of running most current applications.

The traditional solutions to this problem included rewriting the old application, buying a new application suited to the portable terminal restrictions, or writing a custom mapping program that would "map" the fields, prompts and responses from their respective positions on the targeted computer display to the more usable positions on the portable device. Rewriting the old application takes time, costs money and risks the introduction of bugs into the existing system.

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Buying a new application involves significant expense and risk.

Custom mapping programs are expensive and time consuming to create and increase the maintenance cost of the application as changes in the application program could require further changes in the custom mapping program. In addition, custom mapping programs can create synchronization problems. The need to synchronize becomes obvious when you think about the impact of an error message not being seen by an operator who continues to type ahead. Therefore, custom mapping programs are not a satisfactory solution to the problem.

The present invention solves this problem by acting as an intelligent trainable interface between an existing application and a new computer system. The result is that the present invention allows the use of existing computer software with hardware for which it was not originally designed. Specifically, it provides a means of interfacing with the existing program, processing the data from the display screens of that existing program and presenting these data to the user in a different manner and/or format. Similarly, it accepts data from the user, reformats the data if necessary, and presents the re-formatted data to the existing application.

One goal of the present invention is to provide a system that can translate or convert an existing software application's user interface, so as to operate on a new computer system. In addition, it is a goal of the present invention to provide a system that utilizes a simple scheme to educate or train the system to translate an existing software

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application's user interface. A further goal of the invention is to provide synchronization mechanisms to sync operation of a portable device to that of an existing software application. An additional goal of the invention is to provide robust error handling of application errors.

#### Summary of the Invention

By means of this invention, existing application software may be utilized on a system which does not provide the required level of user interface functionality.

The invention discloses an trainable apparatus for translating an existing software application's user interface. The apparatus comprises a computer adapted to communicate with both a host computer and client computer. The apparatus intercepts the host computer's input/output stream and translates the application user interface into a client user interface for use on the client computer. The computer is additionally adapted to simplify user interactions with the application by hiding repetitive tasks and redundant information conveyed by the application user interface. The computer is further adapted to unify host applications into a single user interface.

A method of creating and training the apparatus is also disclosed. The apparatus is trained by the monitoring of a user's interaction's with the application. The monitoring process creates a path history utilized by the apparatus for translating the application user interface.

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#### Brief Description of the Drawings

Fig. 1 is a block diagram of a prior art computer system utilizing handheld or portable terminals.

5 Fig. 2 is a diagram illustrating the functional difference between a portable terminal and a terminal targeted by the application.

Fig. 3 is a block diagram of a computer system utilizing the invention to interface to portable terminals.

10 Fig. 4 is a block diagram of the Virtual User paths created during the education process.

Figs. A-KK are screen printouts of one embodiment of the present invention.

#### Detailed Description of the Preferred Embodiment

Fig. 1 shows a prior art computer system using a portable terminal. A computer system 10 runs an application 12 specifically designed for a portable terminals 16. This application 12 interacts with the user 14 through the portable terminal 16. The application 12 communicates with the portable terminal 16 through a communications medium 18 such as infrared, radio frequency or even direct wire. The portable terminal 16 displays to the user 14 prompts requesting specific information. The user 14 enters replies into the portable terminal 16 in response to these requests.

25 If the application program is not designed to run on the portable terminal, the user will be unable to interact with the application. For instance, referring to Fig. 2, the application may require a terminal 20 with a full size keyboard 21 including functions keys, which keyboard is

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different from the keyboard 23 available on the portable terminal 22. The application may also require a terminal 24 whose screen size is larger than the screen 25 on the portable terminal 22. In either situation, the application will be  
5 unable to run on the portable terminal without some form of change to the system.

Fig. 3 shows a computer system utilizing the present invention. A computer system 30 runs an application 32 that is not designed for use with a portable terminal. The present invention 34 is interposed between the application 32 and the portable terminal 36. The application 32 communicates through communications medium 33 with the present invention 34 which in turn communicates with the portable terminals 36 through a communications medium 38. Again, the portable terminal 36 displays to the user 39 prompts requesting specific information, but these prompts are generated by the present invention 34 and not the underlying application 32. The user 39 enters replies into the portable terminal 36 in response to these prompts, but these replies are again captured by the  
10 invention 34 and not necessarily passed directly to the application 32.  
15

The present invention may reside on the same computer system as the underlying application program or may reside in a separate computer system and communicate with the  
20 application program through a network. In either situation, the present invention intercepts the I/O stream and translates the user interface for use on the portable terminal. The present invention may also be used to simplify access to an  
25

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existing program or group of programs even though access is through the same computer system as that of the existing program(s).

In order to interface and translate between an existing application and a portable terminal, the present invention creates a Virtual User (VU). A VU appears to the existing application as a real user. The VU is trained to operate the existing application, just as a real user would, and to present data to the real user in a format compatible with a portable terminal.

The VU is created, prior to use in the final system, by monitoring the interactions of a human user while operating the application. In the background, the present invention is creating a "path file" that the VU will use to automatically navigate through the particular task in the application. The path file consists of a series of automatically generated "steps" created during the training process that the VU later executes in a linear or branched sequence so as to move around the application. Every cursor stop in an application is reviewed by the VU and at least one step, possibly a series of steps, is associated with the stop.

The present invention provides three features to facilitate the creation of the VU. First, the present invention utilizes a menu driven interface to facilitate the process of creating the VU, making the process interactive as opposed to "off line". The user is not required to program in the classical sense, but rather just to interact with the application.

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Second, the VU can create and utilize functions not available on the underlying application. Because the present invention is simply following a pre-defined set of steps, any combination of keystrokes a person can enter, a VU can also.

5 This allows the VU to be trained or educated to navigate around the entire application, enter and exit different applications, and even access and exit different hosts. For example, an application may have two menu options: the first menu would list the quantity of item on hand and second menu  
10 would list the location of item. A typical user directly accessing the application would have to enter the first menu option to get the quantity, exit the first menu option, enter the second menu option to get the location just to get both pieces of information. The VU can be trained to do the same  
15 steps but present the user with one screen that has both pieces of information. Therefore, the present invention can create new functions for a user that were not previously available by running a particular application "straight through as written".

20 Third, the present invention provides streams monitoring that allows the VU to synchronize itself with the application. The VU must be synchronized with every application cursor stop prior to sending any keystrokes back to the host. The use of streams monitoring allows the VU to "recognize" the current  
25 cursor position and hence determine on what screen of the application it is "looking at".

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## Creating and Educating the Virtual User

In order to translate an applications user interface, the VU must be created and educated.

The following is a list of all the commands accessible  
from FILE, VARS, HOST, CLIENT and MISC selections of the menu  
bar i\of the present invention during the education process.

## FILE MENU



**VARS MENU**

- |    |                           |  |
|----|---------------------------|--|
| 20 | <b>Declare Variable</b>   | : declare a variable to be used in the path file you will create   |
|    | <b>Set Variable</b>       | : initialize a variable already declared to a starting value   |
| 25 | <b>Branch on Variable</b> | : define the <i>path name</i> the program will branch to when a variable equals the "to match" field defined here. NOTE: "No." selects the step # in the <i>path</i> . |

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**HOST MENU (first time)**

5           **Connect Local (PTY)** : defines connection method to host application as *pseudo terminal* access to the same computer the VU is running on.

10           **Connect Local (Pipe)** : defines connection method to host application is via a *pipe* to the same computer the VU is running on.

15           **Connect via TELNET** : defines connection method to host application is via *telnet*, in this case the application is running on different computer than the VU.

20           **Connect via Serial** : defines connection method to host application is via a *serial port* on the computer the VU is running.

**HOST MENU**

25           **Send to Host** : send any combinations of keystrokes to the host

30           **Wait for Host** : synchronization step that makes sure the VU and the host application are at the exact same character of a given application at a given time

35           **Save Host Screen Data** : save a particular *window* of the host screen, often used to store error messages that appear on the

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same line of the screen every time.

5           **Bypass Virtual User** : allows you to stop the interactive training and key data directly into the host application.

#### CLIENT MENU

- 10           **Clear Screen**           : send the command sequence to clear the screen
- 10           **Sound Tone**           : send the command sequence to sound the bell tone
- 15           **Move Cursor**           : send the command sequence to move the cursor to a specific x, y coordinate of the Client screen
- 15           **Send Message**          : send a string of characters to the Client for display
- 20           **Get Reply**            : request a reply from the Client  
   (Scanner or keyboard input)

#### 20           MISC MENU

- 25           **Start New Path**       : defines the current step as the beginning of a path, used as the *connection point* when using the *connect* statement below.
- 25           **End Path**            : defines the end to a path
- 25           **Connect (Loop)**      : allows program flow to be redirected to a path label specified using the "Start New

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Path" option above.

5                   **Exec Procedure** : allows program control to pass to a pre-defined procedure, procedures are available for **Terminal Mode**, Logon, etc.

By selecting various options from the menu bar defined above, one can access the application for which the VU will be trained. After accessing the application, one can  
10 interactively train the VU to react appropriately to prompts in the application.

An important concept is **application program flow**. Application program flow is the sequence of data input prompts that must be followed for use of a particular application.  
15 These prompts include menu selections, data and time entries, and other inputs as is required in order to operate an application. The present invention provides a method of pre-defining and remembering how someone interacts (e.g. a Virtual User) with an application.

20                  The first step for a person using any application is to be trained on how to interact with the application. The VU, however, can be trained to remember keystroke sequences that are repetitive, access system time and date information - never forgetting how to do it. The VU must be trained on how  
25 to react to **cursor stops** that an application makes. After being trained in how to react to the cursor stops/prompts, the VU will be able to operate the same functions in the application by itself.

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To facilitate data input, the VU must be trained to prompt for Client data input. Clients are the terminals (RF handhelds, regular terminals, etc.) where an operator will enter data. The VU simplifies the operation of an application without requiring any programming changes in the application. The VU does this by automating the majority of the application cursor stops/prompts and only passing through to the Clients that information required for the particular task at hand. At each cursor stop in the application there is the option of prompting Clients for data or doing any of the other functions the menu bar allows. This option allows the VU to vary its response to a given application cursor stop. In this way, the present invention ensures that the can branch in the execution of steps.

The following is a list of the basic steps of a typical Virtual User training session.

- 1) Host Connection/logon/application access
- 2) Client Menu
- 3) Host application access
- 4) Automated navigation through access menus
- 5) Prompting for Client data input
- 6) Branching and error instruction based on Client data
- 7) Looping to start the Client task over again or returning to a Client Menu

By repeating these parts for whatever *function* you are trying to perform you can create simplified user input screens

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for the portable terminal operators. Because the VU is simply navigating through an application the same way a person would only at 66MHz (the clock speed of the computer) you can train it to do tasks that you would not expect a person to be able to perform in a timely manner. This simple concept allows you to put together functionality from several menu options of an application (even several different applications) and create a single operator screen that might not even exist in the original application.

The details of each of these steps will become more clear through the following example training session. Note that the figures referred to in the example below show three important areas. Each figure represents the training screen of the present invention. At the top of the figures is the menu bar used to access the function menus describe above, as illustrated by Fig. A-a. In the middle of the figures is a model Client window labelled "CLIENT", reflecting the size and shape of the screen on the Client computer system, as illustrated by Fig. A-a. This screen is defined in the Spec file. An example Spec file is included as Appendix B. Finally, a "Host window shade", labelled "HOST", will pop up as needed to show messages and prompts sent by the host. This is illustrated by Fig. I-c. The CLIENT, HOST and invention menus show the state of the system during the education process. When the education process is finished, the completed VU will operate as trained.

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Example Virtual User Training/Education Session

The following is a simple application example as run by an actual user to illustrate the creation of a VU. Throughout the following text [] are used to represent selections that are to be selected using the pull down menus or to represent actual keys to press. For example: select [Start New Path] means to highlight the selection "Start New Path" in a pull down menu, press [end] means to press the end key.

10 Step 0: (Fig. A-a through A-d)

Access the Misc. menu and select the [Start New Path]. You must define the name of the path you are starting, this is important for looping and branching control. The path name specifies the point in the path for branch and loop access. 15 In this example the name [main\_menu] has been selected since this is the point at which the main menu will be displayed.

Step 1: (Fig. B-a through B-b)

Access the Client menu and select [Move Cursor]. This 20 will set the cursor position in the client window. The default settings of row: 1 and col: 1 are have been selected. The cursor in the client window moves to the x,y position or 1,1 as a result.

25 Step 2: (Fig. C-a through C-b)

Access the Client menu and select [Clear Screen]. The client screen is cleared as a result.

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Step 3: (Fig. D-a through D-h)

Access the Client menu and select [Send Message]. A submenu is displayed. Access the Type submenu and select [Text] and enter the message to be displayed on the client screen. In this example the message [Do you want to run the program y/n] is entered. The text "Do you want to run the program y/n" is now displayed on the client screen, split into lines of length appropriate to fit on the Client screen. The system is now ready to get a reply from the client.

10

Step 4: (Fig. E-a through E-c)

Access the Vars menu and select [Declare Variable]. A variable may be declared to store the response from the client to the question in Step 3. The variable name [answer] is 15 entered.

Step 5: (Fig. F-a through F-b)

Access the Client menu and select [Get Reply]. Type [answer] [tab] [1] to enter "answer" as the variable the 20 response from client will be stored into and sets the maximum length equal to one character. Note that the [backspace] now works as would normally be expected for editing mistakes.

Step 6: (Fig. G)

There are two options that need to be defined. The first 25 is for a "y" or yes response, in general a typical training procedure would be to go through the "normal" path required to operate the application. In this case normal means "y", so we

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will respond with a "y", later in the example the training for the "n" can be entered.

Step 7: (Fig. H-a through H-c)

5 Access the **Vars** and select [Branch on Variable]. Type [answer] [tab] [y] [tab] [start\_rw] [tab]. This defines the action: if the variable "answer" equals the value "y" then proceed with the path named "start\_rw". In the next menu select [d] to declare a pathname. At this time the "n" action  
10 may also be defined. Type [n] [tab] [exit] [tab] [d] which causes the path "exit" to be run when "answer" is equal "n".

Now the path named "start\_rw" is created.

15 **Host Connection/logon/application access:** for our training example we will be running both the application and the present invention on the same host. The application is therefore referred to as running on a **local host** as opposed to running on a different or **remote host**. The following  
20 instructions apply to accessing an application via a pseudo terminal (PTY) on a local host only. You have to be logged onto the local host in order to run the present invention, therefore, with this method of connection you are not required to logon to the host prior to accessing the application.  
25 Refer to the applicable section for other connection methods.

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**PATH NAME: start\_rw**

**Step 0: (Fig. I-a through I-c)**

Access the Host menu option. Once you are "in" the menu bar you may use the arrow keys to navigate. Use the down arrow to "pull down" the HOST window shade. Select [Connect Local (PTY)] by highlighting this option and pressing [enter]. You will now be prompted for Command: enter the keys you would normally use to access your application, for real world type [go\_rw], you can leave the Argument: line empty, press [end] to complete this step. You will notice that when you press [end] the Virtual User sends your keystrokes as a command line entry to the host. You should now see the first screen of the Real World application in the terminal (middle) window.

**15 Alternate using [Exec Procedure]**

**Step 0:**

Access the Misc menu and select [Exec Procedure]. Type [go\_rw] [end].

20

Automated Navigation through access menus: you are now ready to train the Virtual User how to navigate through your application. As you will see, the first step to perform at cursor stops is a "Wait for Host" step. This operation makes sure that the Virtual User and host application are synchronized with each other. If you try to send information to the host it will ask you to perform a "Wait for Host" first. The order that you prompt for Client input is entirely

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up to you, this tutorial follows some basic guidelines.

**PATH NAME: nav\_menus**

**Step 0: (Fig. J-a through J-c)**

5 Access the **Misc** menu and select [Start New Path] [enter]. Type [nav\_menus] [end]. NOTE: "nav\_menus" was chosen as a name because this path will navigate through the menus required to access our desired transaction. The underscore is required in the name, no spaces are allowed.

10

**Step 1: (Fig. K-a through K-c)**

Access the **Host** menu and select [Wait for Host]. Press [enter] and use the down arrow to select [automatic], press [enter] [enter]. You have now confirmed an automatic host synchronization for the string "o continue, or ESC to exit" to appear at the bottom of the Host screen.

**Step 2: (Fig. L-a through L-c)**

20 Access the **Host** menu and select [Send to Host]. In the submenu select [Special Char(s)]. Press [enter], you should see <cr> in the window, press [.] [enter], edit using the [tab] key where necessary, press [end] to activate this step. You should see the application respond to the VU's carriage return with the next screen, now you need to enter your initials.

25

**Step 3: (Fig. M)**

We could easily "hardcode" a set of initials by using the sequence in step #2 or we could prompt the Client for "User

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Initials". To prompt the Client for user initials, proceed as follows. Access the Client menu, use the down arrow to select [Clear Screen]. The Client screen should now be blank, you might not see any change because the old prompt "Real World 5 (y/n)?" is hidden behind the terminal window.

**PATH NAME: item\_transfer**

**Step 0: (Fig. N-a through N-c)**

10 Access the Misc menu and select [Start New Path]. Type [item\_transfer] as the name of the path. This path will prompt the Client with information to complete an item transfer transaction. The program will give you the option to link the last path "access" to the new path "item\_transfer".  
15 Press [n] to select "link to New Path".

**Step 1: (Fig. O)**

As in prior steps, we will clear the screen. Access the Client menu and select [Clear Screen]. The Client screen 20 should now be blank.

**Step 2: (Fig. P)**

As above, access the Client menu and select [Move Cursor]. Select row 1 and column 1. The cursor should now 25 blink at the x,y position of 1,1 on the Client screen.

**Step 3: (Fig. Q-a through Q-b)**

Access the Client menu and select [Send Message]. Select

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[Text] in the submenu. The message to be displayed on the Client screen is now entered. Enter [item: ]. The prompt "item:" now appears on the Client screen.

5 Step 4: (Fig. R)

As before, access the **Vars** menu and select [Declare Variable]. The variable for storing the Client response to the item prompt is now declared. The name [item] is entered as the name of the variable.

10

Step 5: (Fig. S-a through S-b)

Access the **Client** menu and select [Get Reply]. The replay from the Client will now be entered and stored into the variable "item". Type [item] [tab] [10] to enter "item" as the 15 variable for the Client's response and a maximum length of ten characters will be allowed. The menu bar will be replaced with **Waiting for Client Input at Client or here**. A valid item number may now be entered.

20 **PATH NAME: update\_host.**

Step 0: (Fig. T)

Access the **Misc** menu and select [Start New Path]. Type [update\_host] as the new path name for this sequence of steps. This path will update the host with the response received 25 under "item\_transfer" path

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Step 1: (Fig. U)

As before, access the Client menu and select [Clear Screen] to clear the screen at this time.

5 Step 2: (Fig. V)

As before, access the Client menu and select [Move Cursor]. Select row 1 and column 1 as the new location. The cursor in the Client window should now be positioned at the x,y location of 1,1.

10

Step 3: (Fig. W)

As before, access the Client menu and select [Send Message]. In the submenu select [Text]. Now the message to be displayed on the Client screen is entered. Enter  
15 [Processing Data]. The prompt "Processing Data" is now displayed on the Client screen.

Step 4: (Fig. X-a through X-b)

Access the Host menu and select [Wait for Host]. Select  
20 [automatic]. This will now automatically synchronize the Host and Client. Note that error handling will be provided in the "None of the above" path of "item\_error" and that the time out is set for 100 x .1 sec = 10 seconds. Therefore, on an error condition, if 10 seconds elapses without a response, then  
25 item\_error will be executed.

Step 5: (Fig. Y-a through Y-b)

Access the Host menu and select [Send to Host]. The

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variable "item" will now be sent to the host. Select [Variable] from the submenu and type [item] as the variable to send to the host. Select [Special Char(s)] from the submenu and enter a [cr]. This will pass a carriage return to the  
5 Host.

**PATH NAME: item\_error**

**Step 0: (Fig. Z-a through Z-b)**

Because data was entered that caused the application to  
10 go into its error handling routine, the cursor is no longer at its normal "next entry" position beside the second prompt "warehouse". Instead it is sitting at the bottom right hand corner of the screen with a message "Press ENTER or F8". Note that the error message "Item not on file" is displayed at the  
15 left hand corner of the screen. Step 4 of "update\_host" had an error handling routine named "item\_error" defined as the path to use if "none of the above" condition is true. Therefore, control has been passed to "item\_error" to handle the error condition. Access Host and select [Wait for Host].  
20 You have now confirmed an automatic host synchronization.

**Step 1: (Fig. AA)**

As before, access the Vars menu and select [Declare Variable]. This variable will store the host data that is  
25 currently in the "error window" on the host screen. Type [item\_error] to declare the variable "item\_error" which will be used in the next step.

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Step 2: (Fig. BB)

- Select the Host window shade and select "save host data". Enter the variable declared in step 1 and use the arrow keys to move the "window" over the error message on the screen.
- 5 Use the shift "+" or "-" keys to increase or decrease the size of the "window" defined by the square brackets in the "Save Host Screen Data" box.

Step 3: (Fig. CC)

- 10 As before, access the Client menu and select [Clear Screen]. The Client screen should now be cleared.

Step 4: (Fig. DD)

- As before, access the Client menu and select [Move Cursor]. Set the row to 1 and the column to 1. The cursor should move to the x,y location of 1,1 in the Client screen.

Step 5: (Fig. EE)

- 20 Select [Sound Tone] from the Client menu. A tone will be issued to the Client to notify the user of an error.

Step 6: (Fig. FF)

- As before, access the Client menu and select [Send Message]. In the submenu select [Variable]. Enter "item\_error" as the variable name and select [Special Char(s)] and define a carriage return and line feed so the next line of text does not overwrite the error message. Select [Text] and enter the message you want displayed on the Client screen.

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Select [Special Char(s)] and enter a carriage return, line feed and the last part of the message to be displayed. In this example, the text "<cr> <lf> Press ENTER to <cr> <lf> continue:".

5

Step 7: (Fig. GG)

As shown in the above steps, declare a new variable "answer" to get the ENTER key from the client in order to continue.

10

Step 8: (Fig. HH)

As demonstrated in the previous steps, get the Client reply.

15 Step 9: (Fig. II)

Wait for the Client response to the prompt.

Step 10: (Fig. JJ)

Wait for the Host prior to sending the "answer" just entered from the Client.

Step 11: (Fig. KK-a through KK-b

The Host is now back at the item input prompt. Access the Misc menu and select [Loop] and connect this error path to the beginning of item\_transfer to once again prompt the client for an item number.

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Note that any error condition can be handled with this technique. It is equally correct to use any of the "Possible Response" areas of the Wait for Host dialogue box. Therefore, 5 additional "known" responses can be declared and "trained" in a similar manner as above. If you only want to train the VU for one error response that all conditions will use, then the "none of the above" option is appropriate.

Fig. 4 illustrates the interconnection of the various paths described in the above example. The VU trained as 10 described above is now ready for use as an interface between the example application and a portable terminal.

#### Path File Primitives

The Path file specifies the sequence of steps and 15 commands captured during the education process of the VU. Appendix A contains the Path file for the example VU illustrated above. The following primitives are used to record the host program behavior and the interaction with the human operator:

20

\$endact:	terminate path file
\$cl_connect:	establish client connection
\$cl_clear:	clear client screen
\$cl_tone:	sound bell tone on client
25 \$cl_move:	position client cursor
\$cl_send:	send data to client
\$cl_get:	get data from client
\$cl_discon:	break connection with client

-26-

\$host\_send: send data to host application  
\$host\_connect: establish connection to host application  
\$host\_discon: break connection with host application  
\$host\_save: store data from emulation area  
5 \$host\_sync: monitor host operation and compare against behavior database  
\$declare: declare a storage variable  
\$param: modify as system parameter  
\$set: change the value of a variable  
10 \$pipe: establish transparent connection between client and host application  
\$new\_path: begin a new sequence of operations  
\$loop: transfer control  
\$done: terminate a path  
15 \$vbranch: conditionally branch on variable value  
\$exec: execute a program procedure

#### Spec File Primitives

The Spec file captures the system dependant information 20 for use by the VU. Appendix B contains the Spec file for the example VU illustrated above. The following primitives are supported in the "program level" interface:

nop: no operation  
25 mark: label program location  
label: label program location  
begin: start a program structure  
end: end a program structure

- 27 -

write: output data to host or client  
display: output data to client  
send: output data to host  
file\_write: output data to disk file  
5 get: input data from client  
read: input data  
find: locate data on emulator screen  
if: conditional execution  
else: conditional execution  
10 endif: conditional execution  
declare: declare storage variable  
param: set system configuration  
set: set variable's value  
eof: terminate spec file  
15 connect: establish connection to client or host  
disconnect: break connection  
monitor: monitor data from host or client and  
compare against expected data  
pipe: transfer data between host or client and  
20 monitor  
configure: set emulation, client I/O, or host I/O  
configuration  
sleep: delay  
capture: enter training mode  
25 include: insert commands from sub-file  
declare\_action: process and store a pathfile  
run\_action: execute pathfile  
file\_open: open a disk file

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	file_close:	close a disk file
	spawn:	execute a system command as a subprocess
	goto:	flow control
	loop:	flow control
5	break:	flow control
	exit:	flow control
	gosub:	flow control
	return:	flow control
	next:	flow control
10	then:	flow control

As disclosed by the example above, the operation of the existing program(s) is performed by the Virtual User program rather than an actual user. Thus the following functions are supported:

- 15 1. The sequence and format of the data obtained from the actual user may differ from that required by the original program.
2. User data may be combined with data from other sources for presentation to the existing application.
- 20 3. Data may be combined from multiple functions of a given application or multiple applications on a single host or even from multiple host computers for presentation to the user. Data may also be passed from one host application to another application with or without user interaction. This allows the generation of new, more complex functionality without writing new application programs.
- 25 4. The virtual user is trained with an interactive real-time, menu driven, manner. The present invention

-29-

monitors the actual behavior of the target host application and stores the details of this behavior for future reference. Many aspects of host program behavior are recorded including key elements of the actual data stream as well as the contents 5 of the emulated screen displays. This behavioral database is used by the VU module to successfully operate the host program (including the detection and interpretation of error conditions) as well as being used as a source of data for presentation to the human operator and/or passed to different 10 data entry screen within the application and/or different host applications.

5. The VU module is able to detect unexpected actions by the host program and report them as exception conditions to the operator and/or learn the behavior and the required 15 response.

The present invention has been implemented in the ANSI C programming language. The present invention runs under the SCO Unix operating system (Santa Cruz, CA) running on a 486 class workstation. The client portable terminal is any device 20 capable of running an ANSI or VT100 terminal emulator. Such a device is the Janus J2010 Handheld (Everett, WA).

It will be appreciated by those of ordinary skill in the art that the present invention can be embodied in other specific forms without departing from the spirit or essential 25 characteristics thereof. The presently disclosed embodiment is therefore considered in all respects to be illustrative and not restrictive.

```
// Example Path File
//  
5 DECVAR answer  
DECVAR item_error  
DECVAR item  
  
NEW_PATH "main menu"  
ACTION $new_path "main_menu" 0  
  
10 ACTION $cl_move "main_menu" 1  
    1 1  
ACTION $cl_clear "main_menu" 2  
    Y  
ACTION $cl_send "main_menu" 3  
    N "Do you want to run" ;  
    <cr> <lf> ;  
    "the program (y/n) :"  
ACTION $cl_get "main_menu" 4  
    answer N 1  
20 ACTION $vbranch "main_menu" 5  
    answer 5  
    Y 0 "start_rw" Y "y"  
    Y 0 "exit" Y "n"  
    N N  
25 N N  
    N N  
EDISPATCH  
  
30 NEW_PATH "start_rw"  
ACTION $new_path "start_rw" 0  
  
ACTION $h_pty "start_rw" 1  
    "go_rw" ; ""  
ACTION $loop "start_rw" 2  
    Y 0 "nav_menus"  
  
35 NEW_PATH "exit"  
ACTION $new_path "exit" 0  
  
40 NEW_PATH "nav menus"  
ACTION $new_path "nav_menus" 0  
  
ACTION $host_sync "nav_menus" 1  
    D 0 N  
45    N 2  
        10 1 "H_" <esc> "[24;42H"  
        24 14 26 "o continue, or ESC to exit"  
        1 1 0  
EDISPATCH  
50 ACTION $host_send "nav_menus" 2  
    N <cr>  
ACTION $loop "nav_menus" 3  
    Y 0 "item_transfer"  
  
55 NEW_PATH "item_transfer"
```

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```
ACTION $new_path "item_transfer" 0
ACTION $cl_clear "item_transfer" 1
Y
5 ACTION $cl_move "item_transfer" 2
1 1
ACTION $cl_send "item_transfer" 3
N "item:"
ACTION $cl_get "item_transfer" 4
10 item N 10
ACTION $loop "item_transfer" 5
Y 0 "update_host"

NEW_PATH "update_host"
15 ACTION $new_path "update_host" 0
ACTION $cl_clear "update_host" 1
Y
ACTION $cl_move "update_host" 2
20 1 1
ACTION $cl_send "update_host" 3
N "Processing Data"
ACTION $host_sync "update_host" 4
D 0 N
25 N 1
10 2 "___" <esc> "[3;27H
0 0 0
0 0 0
EDISPATCH
30 ACTION $host_send "update_host" 5
N item ;
<cr>
ACTION $loop "update_host" 6
Y 0 "item_error"

35 NEW_PATH "item_error"
ACTION $new_path "item_error" 0
ACTION $host_sync "item_error" 1
40 D 0 N
N 1
10 1 " " <^G><esc> "[24;79H"
0 0 0
0 0 0
45 EDISPATCH
ACTION $host_save "item_error" 2
item_error 24 2 16
ACTION $cl_clear "item_error" 3
Y
50 ACTION $cl_move "item_error" 4
1 1
ACTION $cl_tone "item_error" 5
Y
ACTION $cl_send "item_error" 6
N item_error ;
<cr> <lf> ;
```

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```
"Press ENTER to" ;
<cr> <lf>
"continue:"
ACTION $cl_get "item_error" 7
    answer N 32
ACTION $host_sync "item_error" 8
    D 0 N
    N 1
    10 1 " " <^G><esc> "[24;79H"
    0 0 0
    0 0 0
ACTION $host_send "item_error" 9
    Y 0 "item_transfer"
END_ACTION
EOF
```

```

// test capture spec file
//
declare ans ""
declare foo ""
goto start

// -----
// client connection
mark go_client
param $term_size 4,20
declare mode #2
if node = "slave" then
connect remote pipe "/usr/pipes/fc_client"; "/usr/pipes/to_client"
else
connect remote tty "/dev/tty07"
configure remote "raw"
endif

display <cls> <pos 2,1> "ScreenSaver"
display <pos 3,3> "Copyright 1994"
display <pos 4,1> "Orchid Systems, Inc."
display <pos 6,1>
return

// -----
// mark start
gosub go_client
declare action #1

// during development: use "capture"
// during production: use 'unprotect'
capture
// unaction

disconnect host
disconnect remote
eof

```

// designates a comment line  
 |-----  
 | Declare storage variables  
Bypass function definition(s)
Provide for connection to client
Replace with appropriate connect
for production version
set client window size
Read command line argument "#2"
Slave connection is via unix Pipes
Otherwise use a default connection
to terminal no. 7
use in "raw" mode
-----
Clear client screen and display a
standard startup message
-----
return to caller of function
-----
This is the actual start point.
Open the client connection
Read in the PGMFILE specified on
the command line
-----
Execute the capture function
or execute the run\_act function
-----
End connection to host
End connection to client
End the program execution

CLAIMS:

1. An apparatus for translating a first user interface from a preexisting application program running on a host computer to a second user interface running on a client computer comprising:

5 a computer adapted to monitor and capture interactions of a user using said application running on said host computer and further adapted to convert said interaction so that said interactions may be presented on said client computer;

10 first communication means for communicating between said computer and said host computer; and

second communication means for communicating between said computer and said client computer,

whereby said first user interface is modified for use on said second user interface.

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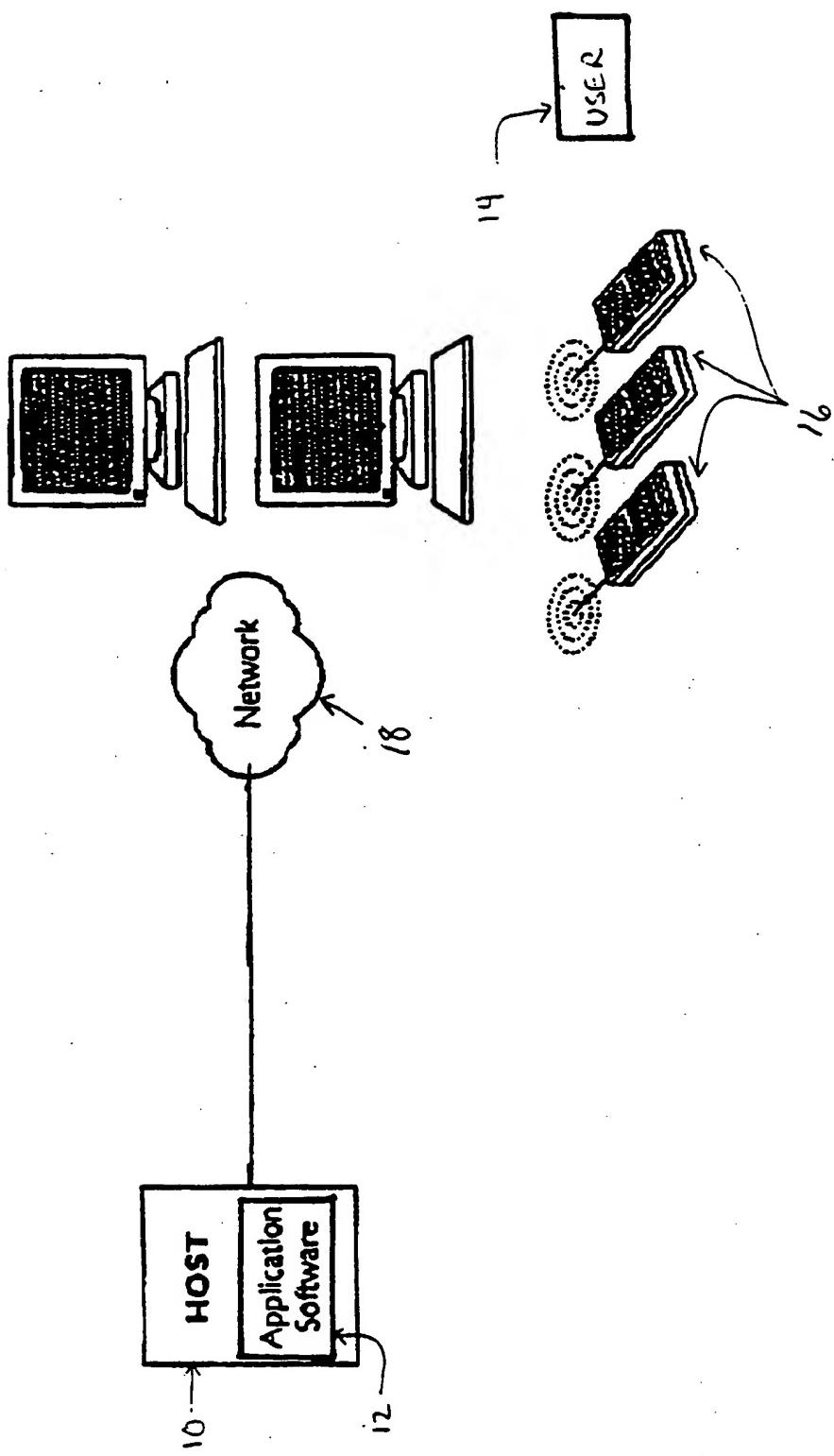


Fig. 1

From: Seth A. Soller To: Robert Anthony

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Date: 4/14/94 Time: 19:54:04

4228 74

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P. 84

IDEAS

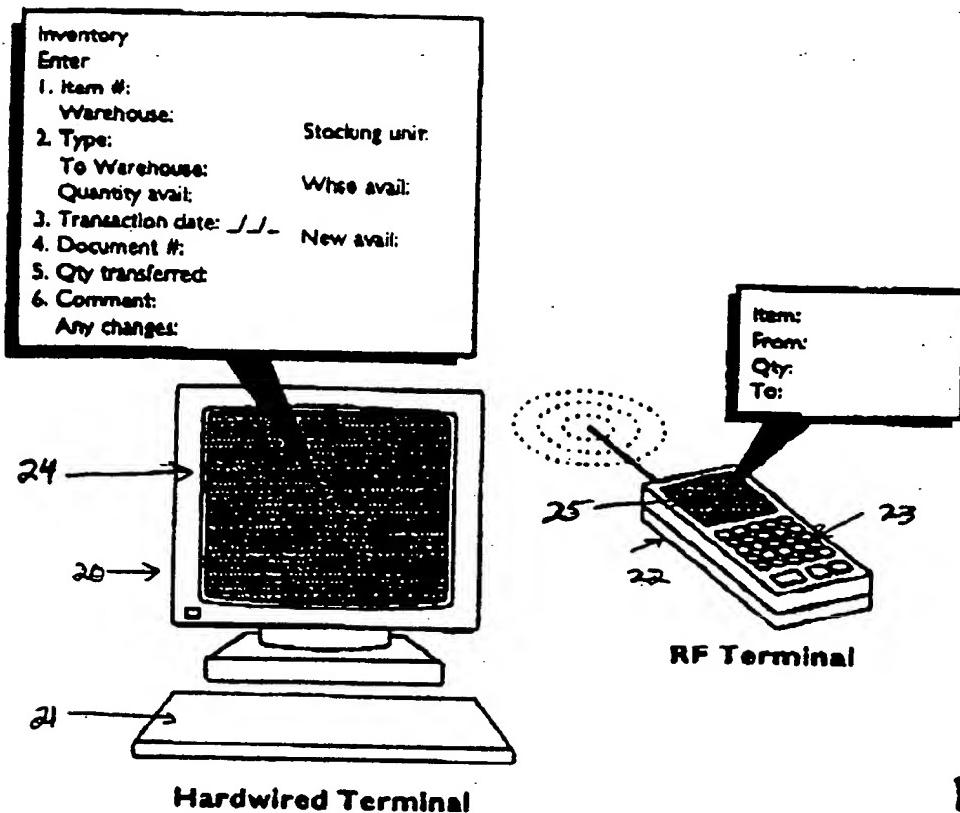
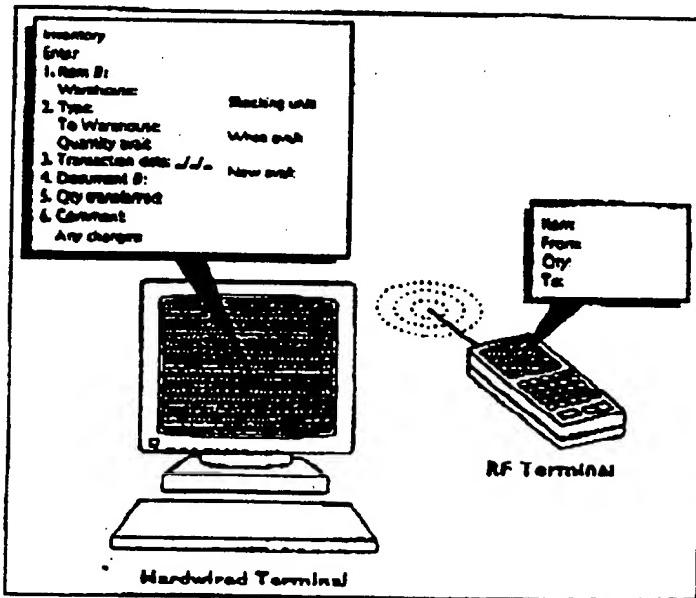
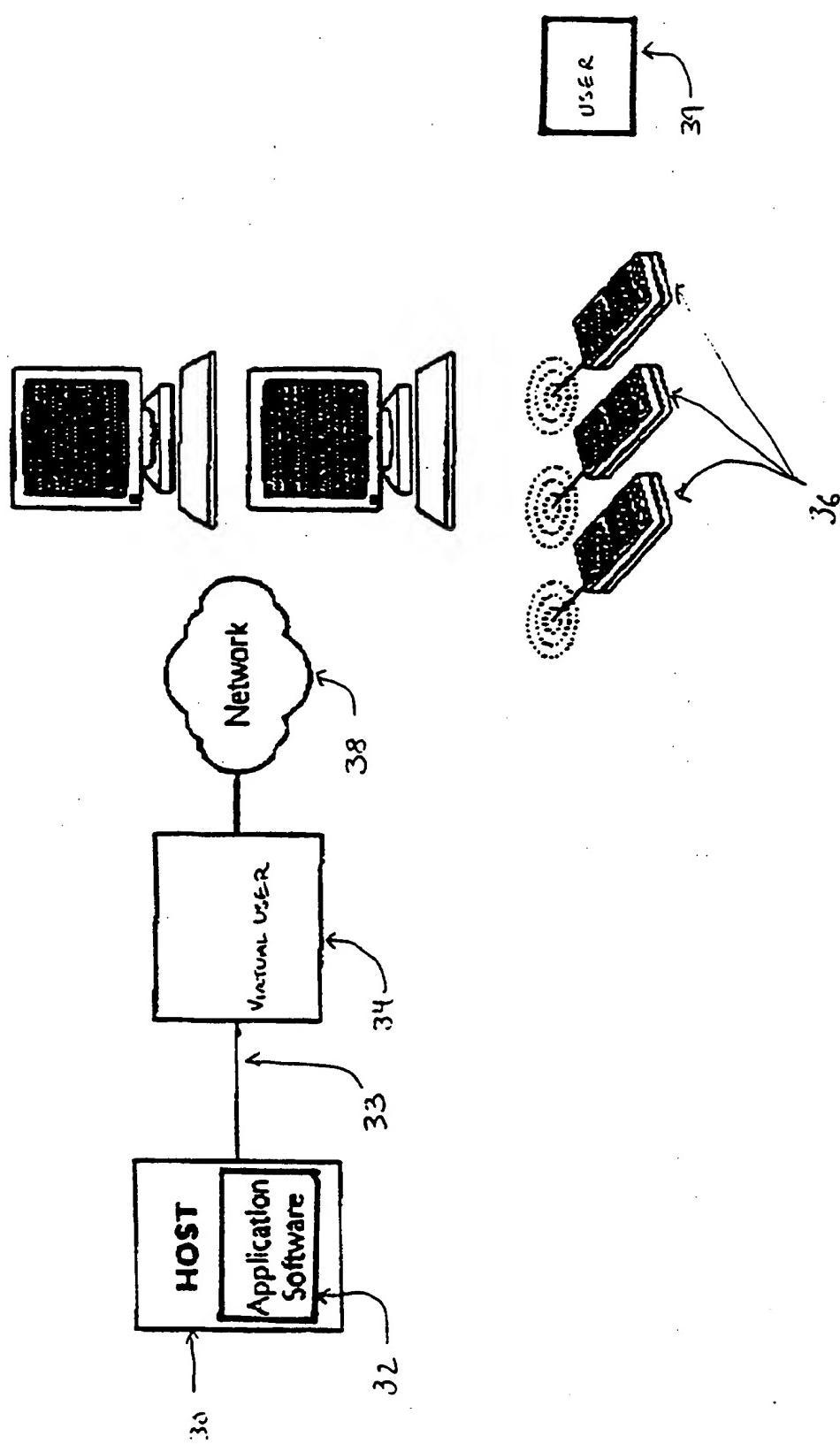


Fig. 2



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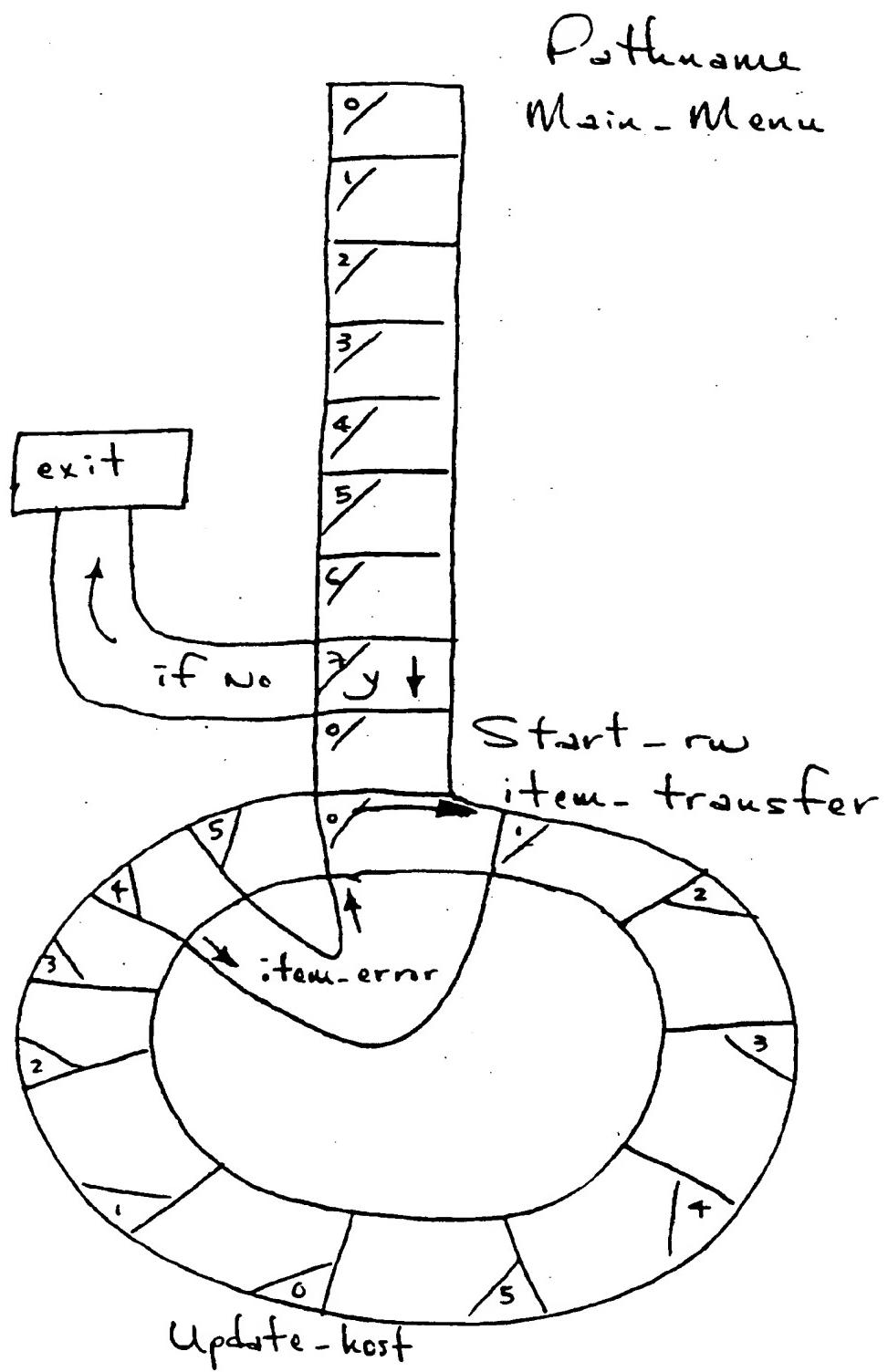
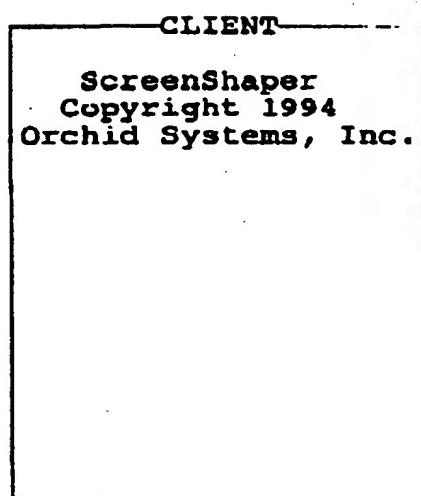


FIG. 4

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File	Vars	Host	Client	Misc.	Monitor
------	------	------	--------	-------	---------



Section 3.3 - 1

FIG A-a

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File

Vars

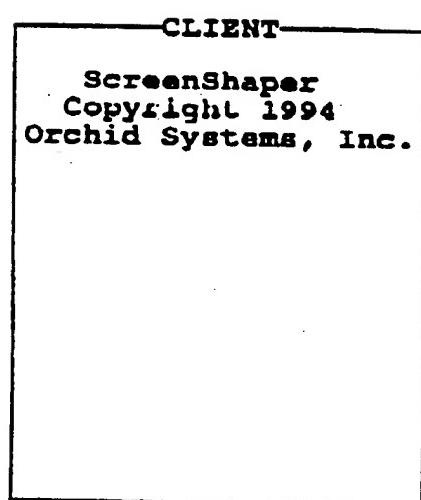
Host

Client

Misc.

Menu

- Start New Path
- End Path
- Loop
- Exec Procedure

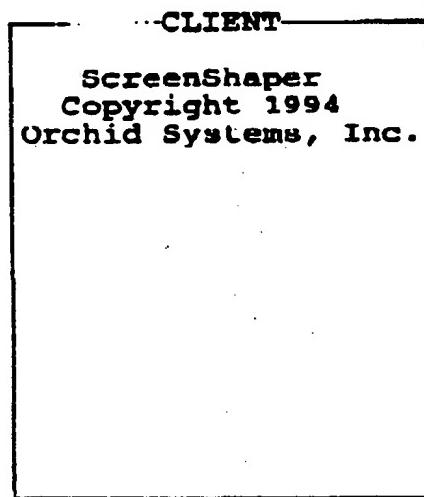


3.3 - 2 Step 0

Fig A-b

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File	Vars	Host	Client	Misc.	Menu
Assign Path Name					
Path Name:					



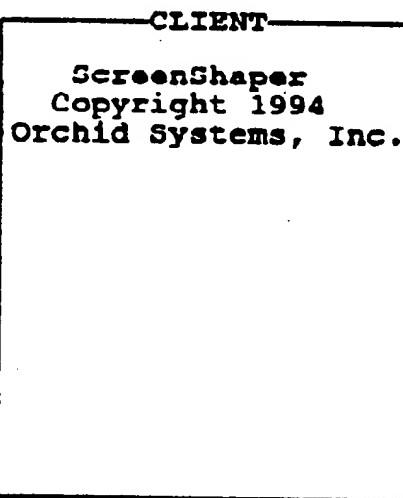
3.3 - 2 Step 0

FIG A-C

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File	Vars	Host	Client	Misc.	Menu
------	------	------	--------	-------	------

<b>Assign Path Nam</b>				
Path Name: <u>main_menu</u>				



Step 0

Fig A-d

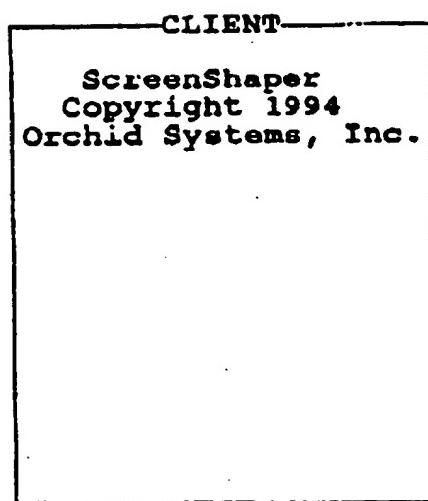
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File      Vars      Host

Client      Misc.

Menu

Clear Screen  
Sound Tone  
Move Cursor  
Send Message  
Get Reply



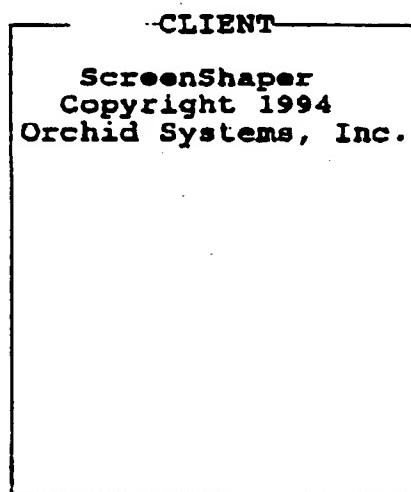
Step 1

FIG B-A

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File	Vars	Host	Client	Misc.	Menu
<b>Move Client Cursor</b>					
Row:	1				
Col:	1				

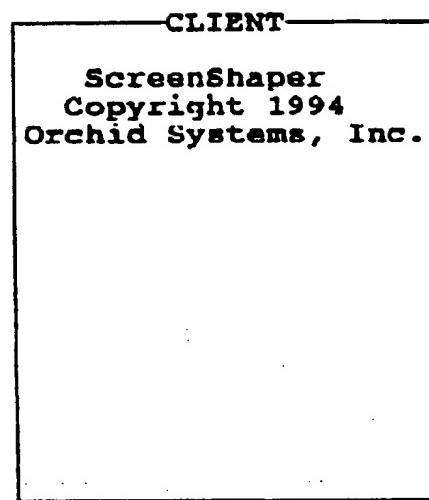
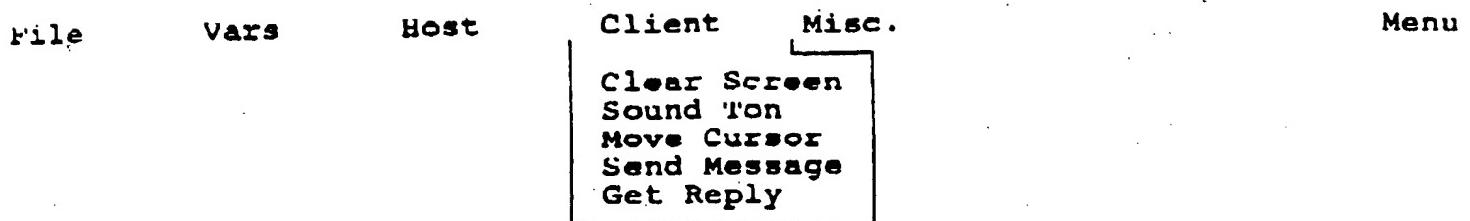


Step 1

FIG 3-B

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Step 2

Fig C-a

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PCT/US95/05009

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File

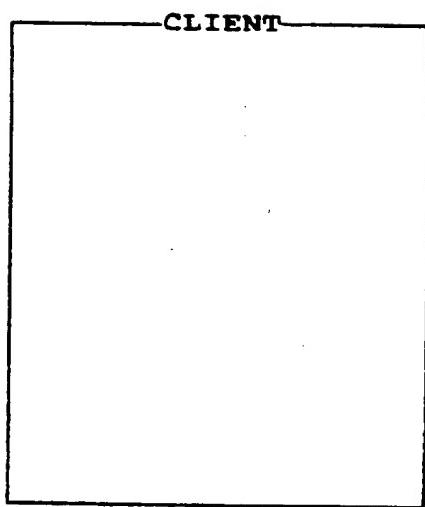
Vars

Host

Client

Misc.

Monitor



Step 3

Fig C-b

1:

WO 95/28673

PCT/US95/05009

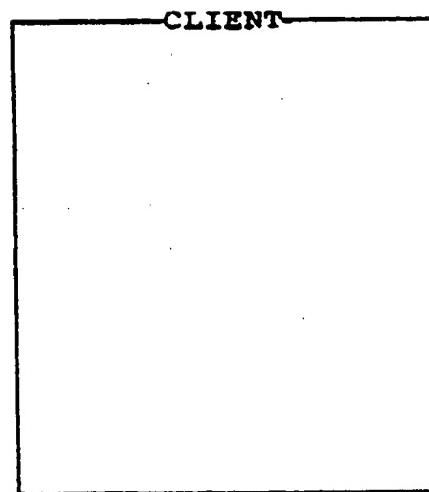
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File      Vars      Host

Client      Misc.

Menu

Clear Screen  
Sound Tone  
Move Cursor  
Send Message  
Get Reply

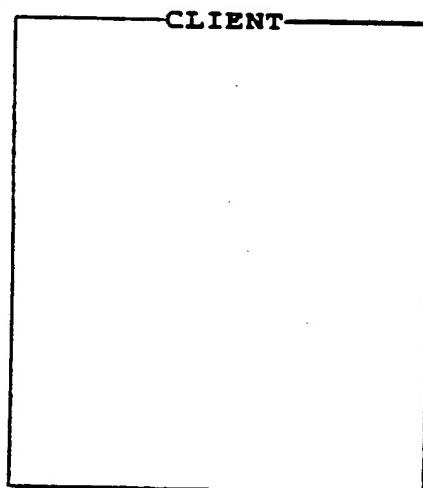


Step 3

Fig D-a

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File	Vars	Host	Client	Misc.	Menu
<b>Send to Client</b>					
Data 1:	Type			Value	
Data 2:	<empty>				
Data 3:	<empty>				
Data 4:	<empty>				

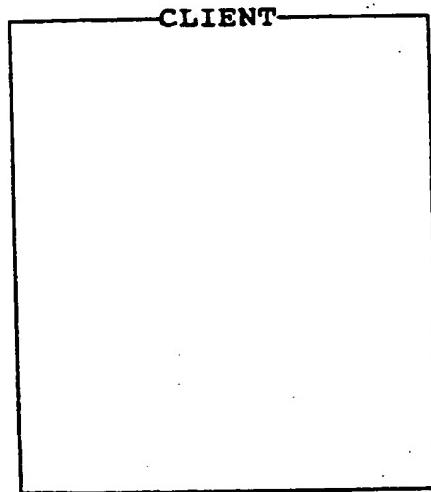
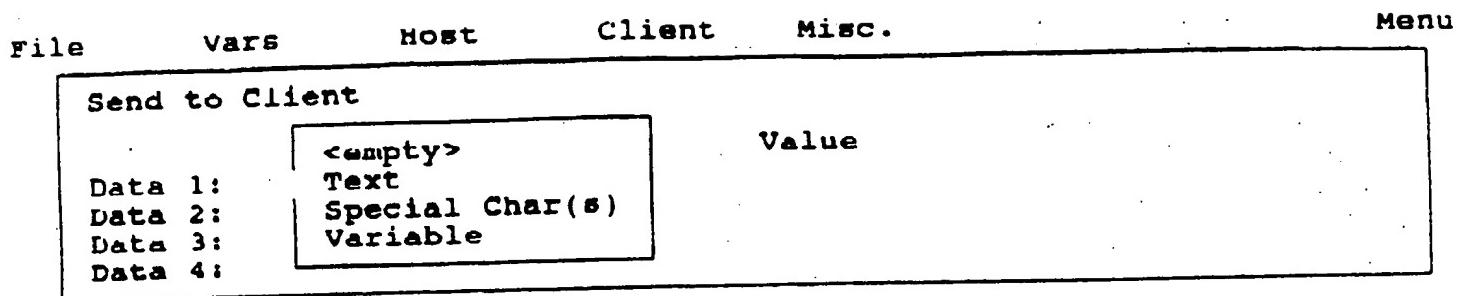


Step 3

Fig 0-b

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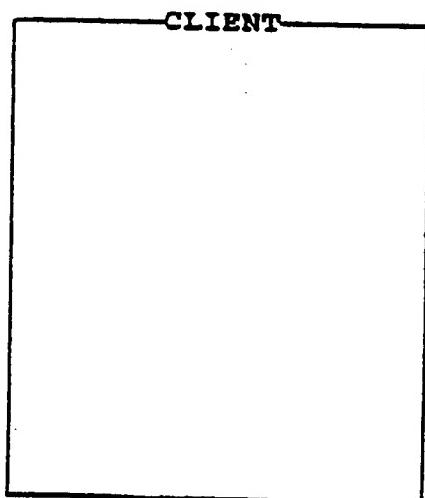


Step 3

Fig 0-c

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File	Vars	Host	Client	Misc.	Menu
<b>Send to Client</b>					
Enter Data					
Dat	Dat	Dat	Dat	Dat	
Text String:					



Step 3

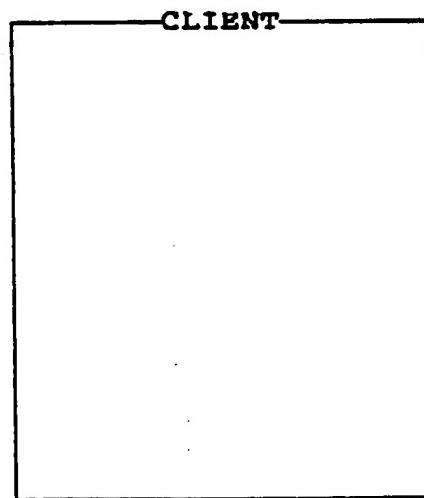
Fig D-d

13

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File    Vars    Host    Client    Misc.    Menu

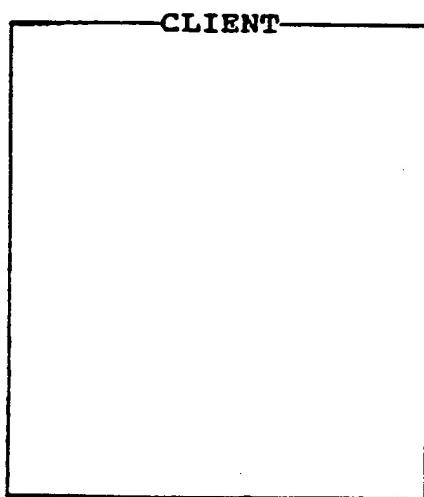
Send to Client	
Data 1:	<empty>
Data 2:	Text
Data 3:	Special Char(s)
Data 4:	Variable
	Value Do you want to run.



Step 3

Fig. D-e

File	Vars	Host	Client	Misc.	Menu
<b>Send to Client</b>					
Dat	Dat	Dat.	Enter Data		
Dat	Dat	Dat.	Text String:the program (y/n):		
Dat	Dat	Dat.			

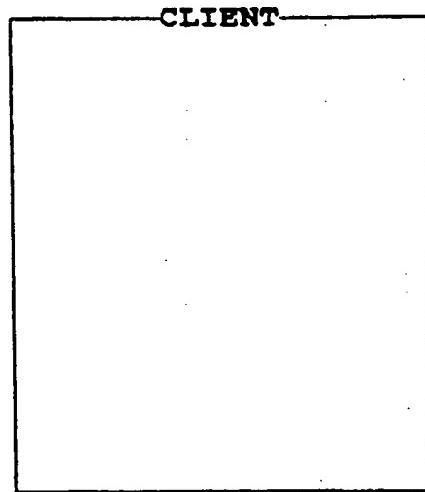


Step 3

Fig D-f

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File	Vars	Host	Client	Misc.	Menu
Send to Client					
	Type			Value	
Data 1:	Text			Do you want to run	
Data 2:	Special Char(s)			<cr> <lf>	
Data 3:	Text			the program (y/n):	
Data 4:	<empty>				

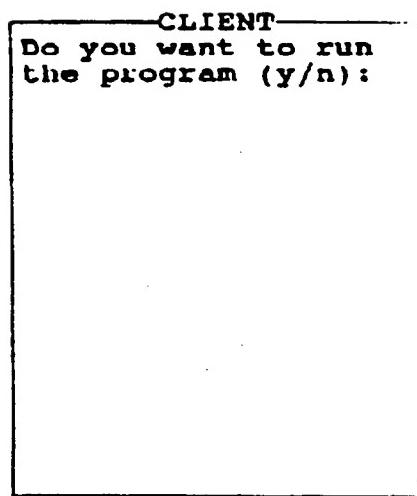


Step 3

F4 D-g

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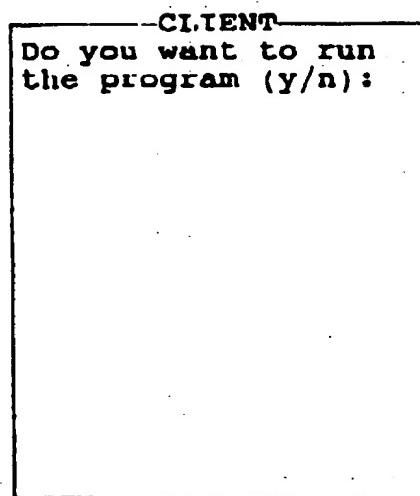
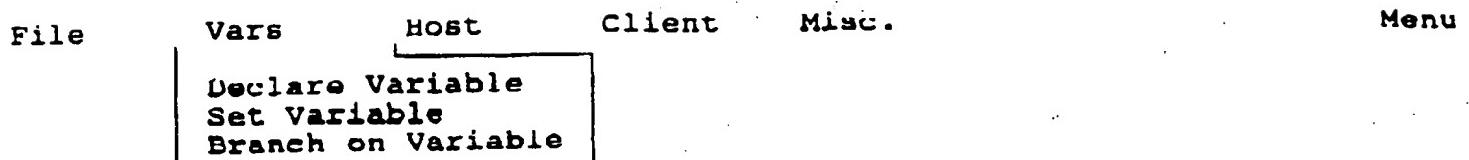
File	Vars	Host	Client	Misc.	Monitor
------	------	------	--------	-------	---------



Step 3

FIG D-h

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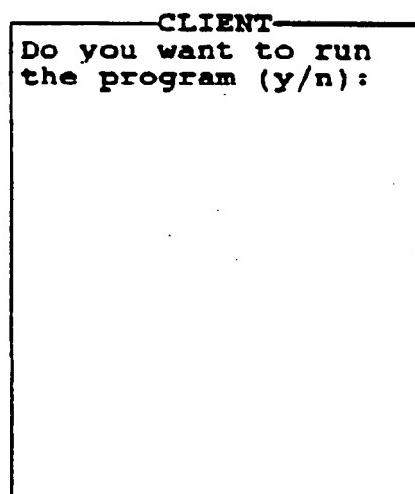


Step 4

Fig E-a

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File	Vars	Host	Client	Misc.	Menu
Declare New Variable					
Variable:					



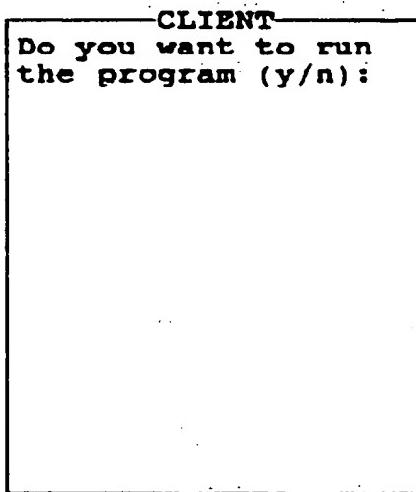
Step 4

FIG E-6

File      Vars      Host      Client      Misc.      Menu

Declare New Variable

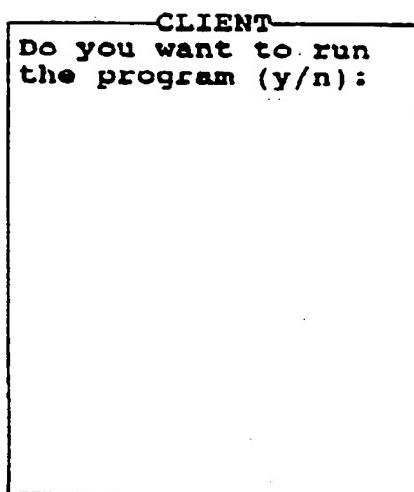
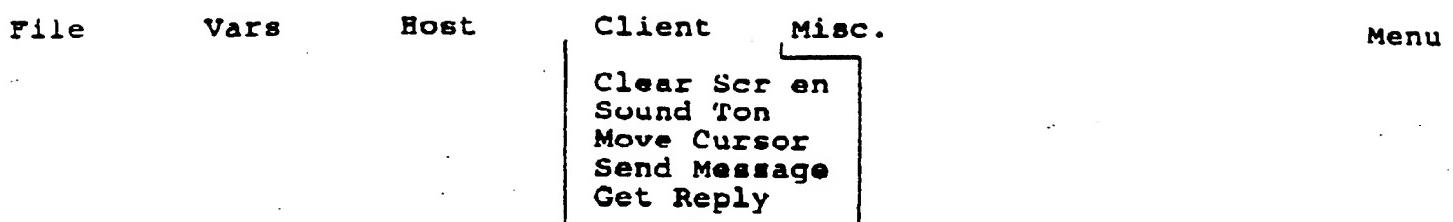
Variable: answer



Step 4

Fig E-C

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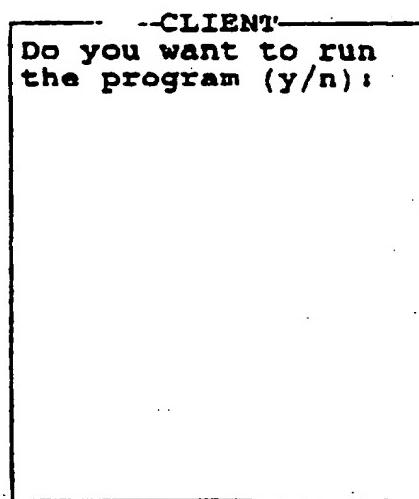


Step 5

Fig Fa

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File	Vars	Host	Client	Misc.	Menu
<b>G t Client R ply</b>					
			Variable Name: answer		
			Max Len: 1		

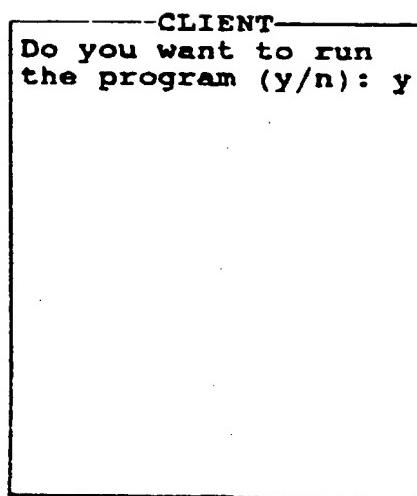


Step 5

FIG F-b

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File	Vars	Host	Client	Misc.	Monitor
------	------	------	--------	-------	---------



Step 6  
Type "y" into  
Client screen

FIG 6

/2

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File	Vars	Host	Client	Misc.	Menu
	Declare Variable Set Variabl Branch on Variable				

CLIENT  
Do you want to run  
the program (y/n): y

Step →

Fig H-a

File

Vars

Host

Client

Misc.

Menu

**Dispatch on Variable****Variable:** answer

	Value to Match	Path Name	No.
1.	eq y	start_rw	0
2.	eq		0
3.	eq		0
4.	eq		0
not eq			0

**-CLIENT-**Do you want to run  
the program (y/n):y

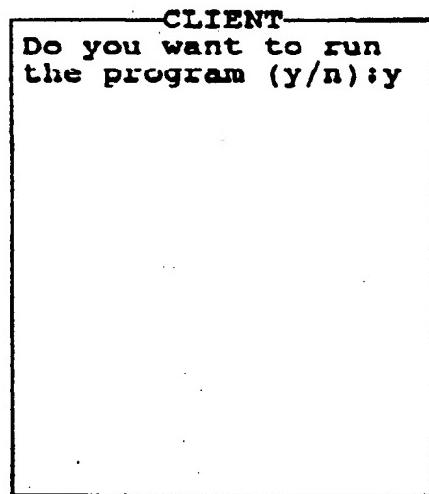
Step 7

Fig. H-6

25

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File	Vars	Host	Client	Misc.	Menu
Ui	Path start rw do sn't exist				
Va		D. Declare Pathname R. Respecify Pathname C. Cancel Operation			No.
1.					0
2.	Select [D,R,C]: R				0
3.					0
4. eq					0
not eq					0



Step 7

F4 t-c

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## File      Vars

<b>Host</b>	<b>Client</b>	<b>Misc.</b>
-------------	---------------	--------------

## Menu

**Connect Local (PTY)**  
**Connect Local (Pipe)**  
**Connect via TELNET**  
**Connect via Serial**

CLIENT

# 3 St. 0

FIG I -A

27

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File      Vars      Host      Client      Misc.      Menu

Connect to Host via PTY

Command: go\_rw

Argument:

CLIENT

Do you want to run  
the program (y/n):y

Stop 0

Fig I-b

12:

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File      Vars      Host      Client      Misc.      Monitor

---

HOST

---

RealWorld Software  
Version 6.5  
Data Look Up Utility 3.0 (C) 1992, 1993 by DataTech  
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---

---

Press ENTER to continue, or ESC to exit

---

---

Step 0

Fig I-c

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File      Vars      Host      Client      Misc.      Menu

Start New Path  
End Path  
Loop  
Exec Procedure

HOST

RealWorld Software

Version 6.5

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Press ENTER to continue, or ESC to exit

Step 0

FIG. 3-a

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File	Vars	Host	Client	Misc.	Menu
------	------	------	--------	-------	------

Current Path start\_sw not ended.

- T. Terminate Path
- E. Link to Existing Path
- N. Link to New Path
- C. Cancel Add Path

Select [T,E,N,C] N

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/ersion 6.5

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Step 0

Fig J-b

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File      Vars      Host      Client      Misc.      Menu

Assign Path Name

Path Name: nav\_menus

-----  
HOST

RealWorld Software

Version 6.5

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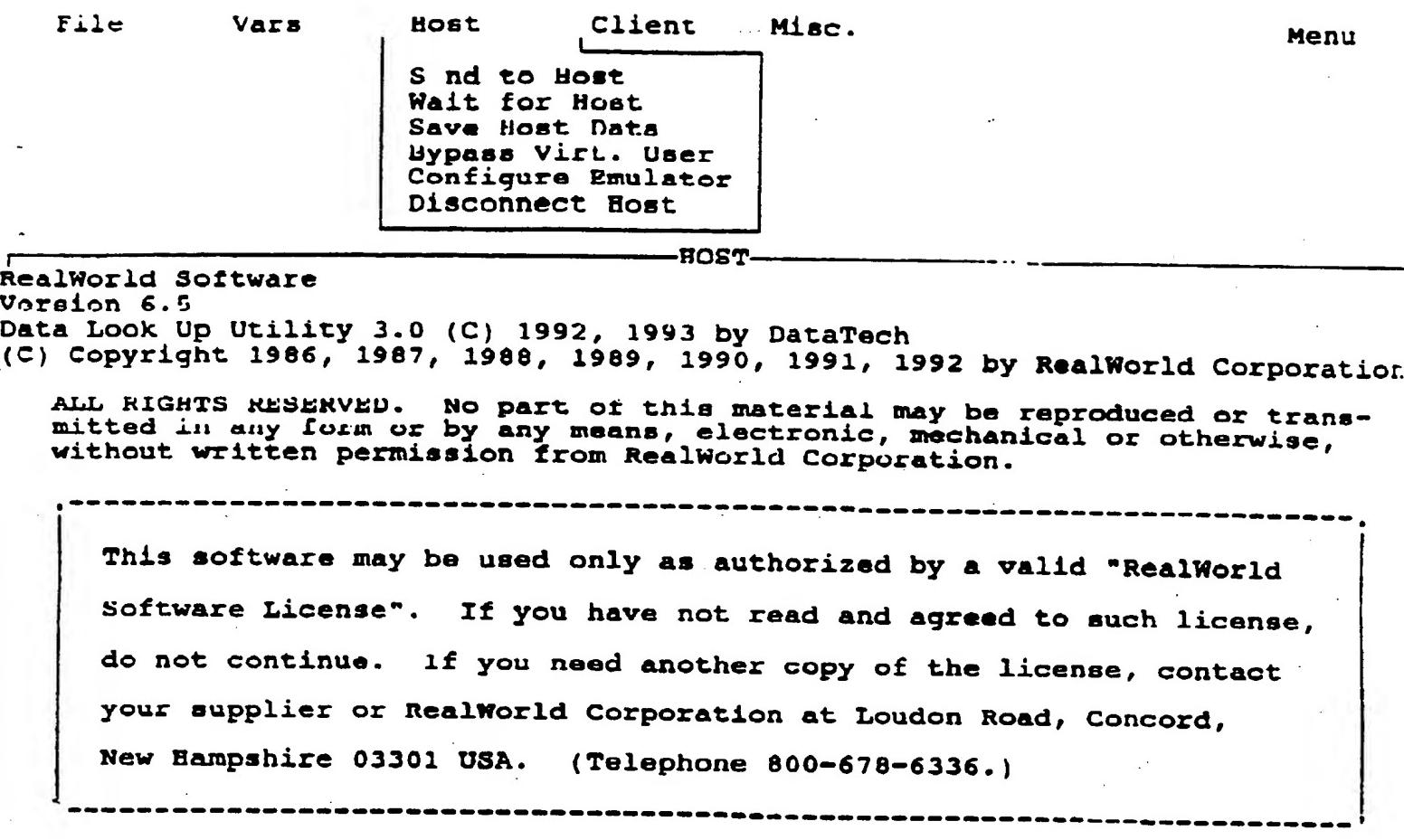
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Press ENTER to continue, or ESC to exit \_

Step 0

FIG J-c

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Press ENTER to continue, or ESC to exit

Step 1

FIG K-9

/34

37/75

File      Vars      Host      Client      Misc.      Menu

Wait for Host Response (s)		Destination Path	No.
Possible Response			
0. Normal Response	-- unused -- automatic screen match		
1.	-- unused --		0
2.	-- unused --		0
3.	-- unused --		0
4.	-- unused --		0
5.	-- unused --		0
6. None of the Above	--- None ---		0

Wait a maximum of 0 x .1 sec

ALL

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Press ENTER to continue, or ESC to exit



Step 1

Fig K-b

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File      Vars      Host      Client      Misc.      Menu

**Define Scr en Match**

	Loc	Len	Expected
Wait For:	10	1	x [H \e[24;42H]
Match at:	24,14	26	[o continue, or ESC to exit]
Match at:	1, 1	0	[]

RealWorld Softw  
Version 6.5  
Data Book Up Ut

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 -----

Press ENTER to continue, or ESC to exit

Stop 1

FIG K-c

/36

34/75

File	vars	Host	<u>Client</u>	Misc.	M nu
			Send to Host Wait for Host Save Host Data Bypass Virt. User Configure Emulator Disconnect Host		

HOST

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Press ENTER to continue, or ESC to exit

Step 2

Fig L-a

37

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File      Vars      Host      Client      Misc.      Menu

Send to Hu	< empty>	Value
Data 1:	Text	
Data 2:	Special Char(s)	
Data 3:	Variable	
Data 4:	<empty>	

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Press ENTER to continue, or ESC to exit

Step 2

FIG L-6

35

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File      Vars      Host      Client      MISC.      Menu

**Send to Host**

	Type	Value
Data 1:	Special Char(s)	<cr>
Data 2:	<empty>	
Data 3:	<empty>	
Data 4:	<empty>	

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Press ENTER to continue, or ESC to exit

Step 2

F4 L-c

39

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File	Vars	Host	Cli nt	Misc.	Monitor
------	------	------	--------	-------	---------

---

realWorld Software  
version 6.5

HOST

MSI

Please enter your initials: \_\_\_\_\_

Press F1 for version numbers  
Press F2 for forms ordering info



Step 3

FIG M

/40

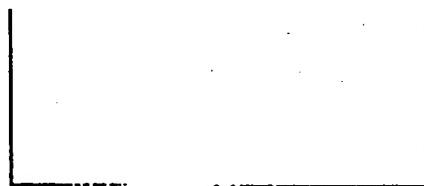
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File	Vars	Host	Client	Misc.	Monitor
------	------	------	--------	-------	---------

---HOST---

Inventory					MSI
Enter					
1. Item #					
Warehouse					
2. Type				Stocking unit	
3. Transaction date					
4. Document #				New qty avail	
				New whs avail	

1 = next entry F2 = next item blank = look up by description



item-transfer  
step 0

Fig N-a

**File**      **Vars**      **Host**      **Cli nt**      **Misc.**      **Menu**

Current Path start\_rw not ended.

- T. Terminate Path
  - E. Link to Existing Path
  - N. Link to New Path
  - C. Cancel Add Path

Select {T,E,N,C} N

## Menu

## Inventory near

**1. Item #**  
**Warehouse**

## 2. Type

## Stocking unit

**3. Transaction date**

**4. Document #**

New qty avail  
New whs avail

**1 = next entry    F2 = next item    blank = look up by description**

MSI

F<sub>K</sub> N-b

45/75

## Menu

file vars Host Client Misc.

Assign Path Name

Path Name: item\_transfer

HOST

MSI

ventory

ter

. Item #  
warehouse

. Typ

Stocking unit

. Transaction date  
. Document #New qty avail  
New whs avail

1 = next entry F2 = next item blank = look up by description

FIG N-c

46/75

File	Vars	Host	Client	Misc.	Menu
------	------	------	--------	-------	------

Clear Client Screen
---------------------

Enable: Y
-----------

---

**HOST**

Inventory

Inter

1. Item #

Warehouse

2. Type

Stocking unit

3. Transaction date

4. Document #

New qty avail  
New whs avail

F1 = next entry F2 = next item blank = look up by description



F4 ①

47/75

File      Vars      Host      Client      Misc.      Menu

Move Client Cursor

Row: 1  
Col: 1

HOST

MSI

Inventory

Int r

1. Item #

Warehouse

2. Type

Stocking unit

3. Transaction date

4. Document #

New qty avail  
New whs avail

?1 = next entry    ?2 = next item    blank = look up by description

Z.

FIG P

48/75

File	Vars	Host	Client	Misc.	Mnu
------	------	------	--------	-------	-----

<b>Send to Client</b>					
Data 1:	<input type="checkbox"/> <empty>			<b>Value</b>	
Data 2:	<input type="checkbox"/> Text				
Data 3:	<input type="checkbox"/> Special Char(s)				
Data 4:	<input type="checkbox"/> Variable				

Inventory

Master

1. Item #

Warehouse

2. Type

Stocking unit

MSI

3. Transaction date

4. Document #

New qty avail  
New whs avail

F1 = next entry F2 = next item blank = look up by description

3

Fk Q-a

49/75

File	Vars	Host	Client	Misc.	Menu
<b>Send to Client</b>					
			Type	Value	
Data 1:			Text	item:	
Data 2:			<empty>		
Data 3:			<empty>		
Data 4:			<empty>		
					MSI
Inventory					
Enter					
1. Item #					
Warehouse					
2. Type Stocking unit					
3. Transaction date					
4. Document #					
New qty avail					
New whs avail					
F1 = next entry F2 = next item blank = look up by description					

FIG Q-D

50/75

File	Vars	Host	Client	Misc.	Menu
------	------	------	--------	-------	------

Declare New Variable					
----------------------	--	--	--	--	--

Variable: item					
----------------	--	--	--	--	--

---

HOST

---

Inventory

Enter

1. Item #  
Warehouse

MSI

2. Type

Stocking unit

3. Transaction date

4. Document #

New qty avail  
New whs avail

1 = next entry F2 = next item blank = look up by description



4

FIG R

51/75

File	Vars	Host	Client	Misc.	Menu
------	------	------	--------	-------	------

Get Client Reply
------------------

Variable Name: item
Max Len: 10

---

HOST

---

MSI

inventory  
item  
1. Item #  
Warehouse

Stocking unit

2. Typ

3. Transaction date  
4. Document #

New qty avail  
New whs avail

---

1 = next entry F2 = next item blank = look up by description

---

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**File**      **Vars**      **Host**      **Client**      **Misc.**      **Monitor**

---

BOST MS 1

Inventory  
Master  
1. Item #  
Warehouse

## 2. Typ

### **Stocking unit**

**3. Transaction date**

**4. Document #**

New qty avail  
whs avail

**CLIENT**

F1 = next entry F2 = next i

**by description**

Note: "1" is a valid item number

FIG. 5-b

53/75

File      Vars      Host      Client      Misc.      Menu

Assign Path Name

Path Name: update\_host

MSI

HOST

Inventory  
Item  
.. Item #  
Warehouse  
.. Type

Stocking unit

3. Transaction date  
4. Document #

New qty avail  
New whs avail

1 = next entry   F2 = next item   blank = look up by description



update\_host

Step 0

Fig T

54/75

**File**      **Vars**      **Host**      **Client**      **Misc.**

## Clear Client Screen

**Enable:** Y

MGDU

Inventory

—ROST.

MS I

... Item #  
Warehouse

### :- Type

### **Stocking unit**

- Transaction date
  - Document #

New qty avail  
New whs avail

= next entry F2 = next item blank = look up by description

Fig. 4

File      Vars      Host      Client      Misc.      Menu

Move Client Cursor

Row: 1  
Col: 1

**HOST**

nventory  
nter  
1. Item #  
Warehouse

MSI

2. Type

Stocking unit

3. Transaction date  
4. Document #

New qty avail  
New whs avail

= next entry   F2 = next item   blank = look up by description

FIG 4

Z.

1-

File      Vars      Host      Client      Misc.      Menu

Send to Client

	Type	Value
Data 1:	Text	Processing Data
Data 2:	<empty>	
Data 3:	<empty>	
Data 4:	<empty>	

Inventory

ter

. Item #  
Warehouse

. Type

Stocking unit

MSI

. Transaction date  
. Document #

New qty avail  
New whs avail

= next entry   F2 = next item   blank = look up by description

3

FIG W

14

File      Vars      Host      Client      Misc.      Menu

Wait for Host Response(s)				
Possible Response	Test Type	Destination Path	No.	
0. Normal Response	automatic			
1.	-- unused --		0	
2.	-- unused --		0	
3.	-- unused --		0	
4.	-- unused --		0	
5.	-- unused --		0	
6. None of the Above	--- None ---	item_error	0	

Wait a maximum of 100 x .1 sec

2. Ty

MSI

3. Transaction date  
4. Document #

New qty avail  
New whs avail

Leave blank for "Central"



Pathname Update - host

Fig X-a

Note: Error handling will be provided in the  
None of the above path "item\_error"

Step 4 Time out set for 100x.1 = 10 sec

1E

58/75

F 1?

File	Vars	Host	Client	Misc.	Menu
			Path it m_error doesn't exist		
	Poss		D. Declare Pathname R. Respecify Pathname C. Cancel Operation		No.
0. Norm					0
1.					0
2.			Select [D,R,C]: R		0
3.					0
4.			-- unused --		0
5.			-- unused --		0
6. None of the Above			--- None --- item_error		0
Wait a maximum of	0 x .1 sec				
2. Try					0

MSI

3. Transaction date  
 1. Document #

New qty avail  
 New whs avail

Leave blank for "Central"

Fig X-b

4

11

File      Vars      Host      Client      Misc.      Menu

**Send to Host**

	Type	Value
Data 1:	Variable	item
Data 2:	Special Char(s)	<cr>
Data 3:	<empty>	
Data 4:	<empty>	

MSI

Inventory  
Item  
1. Item #  
Warehouse

Stocking unit

3. Transaction date  
4. Document #

New qty avail  
New whs avail

1 = next entry   F2 = next item   blank = look up by description

FIC Y-a

5

1--

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File	Vars	Host	Client	Misc.	Monitor
------	------	------	--------	-------	---------

---

HOST

MSI

IV RT RY

Item

.. Item #  
Warehouse

1

Paint, Black

.. Type

Stocking unit EACH

.. Transaction date

.. Document #

New qty avail  
New whs avail

Leave blank for "Central"

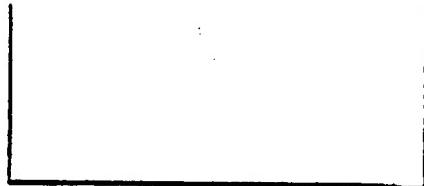


Fig Y-b

5

10

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Fil	Vars	Host	Client	Misc.	Monitor
-----	------	------	--------	-------	---------

---

HOST

---

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## CLIENT

item:15

the license, contact  
100 Concord Road, Concord,  
New Hampshire 03301 USA

---

---

Press ENTER to continue, or E

---

---

Second time through we enter  
invalid data "15" and "train" Virtual User  
how to respond

FIG Z-9

10

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File      Vars      Host      Client      Misc.      Menu

## Wait for Host Response (s)

Possible Response	Test Type	Destination Path	No.
0. Normal Response	automatic		
1.	-- unused --		0
2.	-- unused --		0
3.	-- unused --		0
4.	-- unused --		0
5.	-- unused --		0
6. None of the Above	--- None ---		0

Wait a maximum of 0 x .1 sec

2. Try

MSI

3. Transaction date  
 4. Document #

New qty avail  
 New whs avail

It m not on file

Press ENTER or F8



Pathname item - error

Step 0

Fig Z-b

21

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File      Vars      Host      Client      Misc.      Menu

Declare New Variable

Variable: item\_error

MSI

HOST

Inventory

Item

. Item #  
Warehouse

15

. Type

Stocking unit

. Transaction date  
. Document #

New qty avail  
New whs avail

Item not on file

Press ENTER or F8



FIG AA

22

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File      Vars      Host      Client      Misc.      Menu

**Save Host Screen Data**

Variable: item\_error

Loc Len Expected  
Save at: 24, 2 16 [Item not on file]

HOST

Inventory

ster

- . Item #
- Warehouse

- . Type

15

MSI

Stocking unit

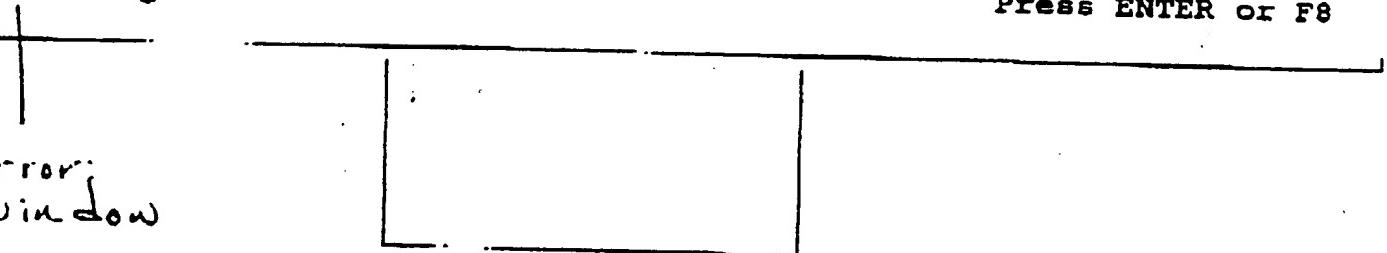
- . Transaction date
- . Document #

New qty avail  
New whs avail

item not on file]

Press ENTER or F8

error  
window



Note: Captures any data  
in error window

2

FIG BB

/2=

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PCT/US95/05009

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**File**      **Vars**      **Host**      **Client**      **Misc.**      **Menu**

## **Clear Client Screen**

Enable: X

## Menu

—HOS:R

MSI

## vventory

.cn

. Item #  
Warehouse

- Type

### **Stocking unit**

- Transaction date
- Document #

New qty avail  
New whs avail

...em not on file

Press ENTER or F8

三

Fig cc

/24

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File      Vars      Host      Client      Misc.      Menu

Move Client Cursor

Row: 1  
Col: 1

HOST

inv ntry

Inter

1. Item #

15

Warehouse

2. Type

Stocking unit

3. Transaction date

4. Document #

New qty avail  
New whs avail

Item not on file

Press ENTER or F8

4

FIG DD

/21

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PCT/US95/05009

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File      Vars      Host      Client      Misc.      Menu

Sound Tone at Client

Enable: Y

HOST

MSI

v nitory  
ler  
. item #  
Warehouse

15

Stocking unit

. Transaction date  
. Document #

New qty avail  
New whs avail

tem not on file

Press ENTER or F8



5

Fig EE

/26

68/75

File	Vars	Host	Client	Misc.	Menu
------	------	------	--------	-------	------

**Send to Client**

Data 1:	Type Variable	Value item_error
Data 2:	Special Char(s)	<cr> <lf>
Data 3:	Text	Press ENTER to
Data 4:	Special Char(s)	<cr> <lf> "continue:"

Inventory

Item

.. Item #  
Warehouse

15

MSI

Type

Stocking unit

Transaction date  
Document #New qty avail  
New whs avail

Item not on file

Press ENTER or F8

6

FIG FF

27

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PCT/US95/05009

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**File**      **Vars**      **Host**      **Client**      **Misc.**      **Menu**

## Declare New Variable

**Variable:** answer

## Menu

-HOST-

MSI

## Inventory

160

• Item #  
Warehouse

**. Type**

### **Stocking unit**

**4. Transaction date**

• Document 8

New qty avail  
New whs avail

is not on file

Press ENTER or Esc

FIG 6G

20

70/75

File      Vars      Host      Client      Misc.      Menu

Get Client Reply

Variable Name: answer  
Max Len: 3

HOST

Inventory

Item

.. Item &  
Warehouse

15

MSI

1. Type

Stocking unit

3. Transaction date

1. Document #

New qty avail  
New whs avail

Item not on file

Press ENTER or F8

8

Fig H4

29

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PCT/US95/05009

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**File**      **Vars**      **Host**      **Client**      **Misc.**      **Monitor**

-HOST-

MSI

ventory  
ter  
. It m  
Kanab

15

. Type Stocking unit

- Transaction date
- Document #

New qty avail  
whs avail

CLIENT  
Item not on file  
Press ENTER to  
continue:

tem not on file

**Press ENTER or F8**

## FIG II

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File	Vars	Host	Client	Misc.	Menu
<b>Send to Host</b>					
		Type		Value	
Data 1:		Variable		answer	
Data 2:		<empty>			
Data 3:		<empty>			
Data 4:		<empty>			

Inventory

Item

1. Item # 15

Warehouse

2. Type

Stocking unit

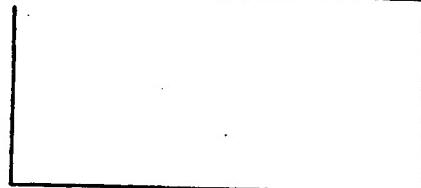
3. Transaction date

4. Document #

New qty avail  
New whs avail

Item not on file

Press ENTER or F8



10

Fig 11

S1

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file	vars	Host	Client	Misc.	Monitor
------	------	------	--------	-------	---------

---

HOST

---

MS

nv ntory  
nter  
1. Item +  
Warehouse

2. Type

Stocking unit

3. Transaction date  
4. Document #

New qty avail  
New whs avail

F1 - next entry F2 - next item blank - look up by description

---



KK-3

11

F12 KK-a

3:

74/75

File	Vars	Host	Client	Misc.	Menu
------	------	------	--------	-------	------

Select Link Destination					
-------------------------	--	--	--	--	--

Path Name:	item_transfer
Index:	0

---

HOST

---

Inventory

Item

- Item #
- Warehouse

---

- Type

Stocking unit

MSI

- Transaction date
- Document #

New qty avail  
New whs avail

---

= next entry F2 = next item blank = look up by description

---

--

VK - V

C.V. VK+

33

75/75

Control Transfer to item\_transfer, 0

S. Single Step  
R. Run to End  
T. Terminate Capture

Select [S,R,T]: R

MSI

Inventory  
Item #  
Warehouse  
Type

Stocking unit

Transaction date  
Document #

New qty avail  
New whs avail

- next entry F2 = next item blank = look up by description



L.V.C

FIG KK-c

34

# INTERNATIONAL SEARCH REPORT

Int'l. Application No  
PCT/US 95/05009

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 G06F9/455

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	IBM TECHNICAL DISCLOSURE BULLETIN, vol.33, no.5, October 1990, NEW YORK, US page 90 'ADDITION OF NEW EHLLAPI PARAMETER TO HIDE NON-DISPLAY-TYPE FIELDS' see the whole document --- IBM TECHNICAL DISCLOSURE BULLETIN, vol.32, no.4A, September 1989, NEW YORK, US pages 290 - 291 'SYSTEM FOR ACCESSING A MAINFRAME FROM A WORKSTATION USER INTERFACE' see the whole document --- -/-/	1
X		1

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search

27 June 1995

Date of mailing of the international search report

18.07.95

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## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 95/05009

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	IBM TECHNICAL DISCLOSURE BULLETIN, vol.33, no.3B, August 1990, NEW YORK, US page 132 'INTELLIGENT KEYSTROKE CAPTURE FOR PERSONAL COMPUTERS' see the whole document ---	1
A	DR DOBB'S JOURNAL, vol.16, no.3, March 1991, US pages 70 - 71, 148 - 149 DAN TROY: 'Remote Connectivity for Portable Terminals Part II' see the whole document -----	1

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